## Autumn Examinations 2015/ 2016

**Exam Code(s)**     4BCT1
**Exam(s)**     4th Year Examination Computing Science and IT

**Module Code(s)**     CT421
**Module(s)**     Artificial Intelligence

Paper No.     1
Repeat Paper     No

External Examiner(s)     Dr. John Power
Internal Examiner(s)     Professor G Lyons
               Dr. J Duggan
               *Dr. C Mulvihill
               *Dr. F Smith

**Instructions:**     Answer 2 questions from each section.  All questions will be marked equally.  Use a separate answer book for each section.

**Duration**     2 hours
**No. of Pages**     3
**Discipline(s)**     IT
**Course Co-ordinator(s)**

**Requirements**:
MCQ                    Release to Library:  Yes ☐     No ☐
Handout                None
Statistical/ Log Tables     None
Cambridge Tables       None
Graph Paper            None
Log Graph Paper        None
Other Materials        None
Graphic material in
colour                 Yes ☐     No ☐

**PTO**

## Section A

1

(a)

In relation to Fuzzy Logic, what is meant by each of the following terms?

Fuzzification

Fuzzy inference

Defuzzification

(10 marks)

(b)

How can fuzzy rules be used to control complex systems? Highlight why fuzzy rules can be more effective than conventional 'crisp' rules.

(10 marks)

(c)

Define fuzzy sets that describe the temperature in a room. There should be three sets, Hot, Warm and Cold with a suitable overlap between them.

(5 marks)

2

a) Describe how GDE. uses minimal conflict sets. What are the advantages of using minimal conflict sets?

(10 marks)

b) What assumptions are necessary when GDE is used to diagnose faults in system?

(6 marks)

c) Describe how The Turing Test works.

(9 marks)

3

(a)

Describe each of the following AI searches, highlight the efficiency of each:

Depth First Search

Breadth First Search

Depth Bound Depth First Search

Depth First Search with Iterative Deepening

(16 marks)

(b)

Describe 2 ways that both forward and backward chaining can be used together.

(5 marks)

(c)

Why is it necessary for reason systems to be able to handle uncertainty.

(4 marks)

**PTO**

# Section B

4

(a) Explain what is meant by the term 'greedy search' (7 marks)

(b) By considering the cycle graph C8, show how one ordering for vertices will give an optimal colouring for a greedy searcher, and another will not. Note: The conditions on the search are that adjacent nodes must have different colours and that the least possible number of colours is preferred (12 marks)

(c) Explain what is meant by the term 'minimax' and apply your definition to discover the minimax value for the following complete binary search tree: There are four leaf nodes, two intermediate nodes, and a root node. The bottom leaf node heuristic values are 7,8, 9, 10, the next level travelling up from the leaves (intermediate level) is a MAX level, and the final level travelling up (root node) is a MIN level (6 marks)

5

(a) In the context of genetic algorithms, explain what is meant by the term 'fitness function' (5 marks)

(b) A software bot (like Mitchell'example) is to be developed for collecting rubbish in a 10 by 10 two-dimensional array. A cell of this array can be empty, contain rubbish, or contain a wall. In terms of context, a bot can see the contents of the current cell, and can also see the contents of one cell north, south, east and west. In terms of actions, a bot can select from the following: Move one cell north, south, east, west, or one step randomly (north, south, east, or west), pick up the rubbish in the current cell, or do nothing. A reward of 20 points results from picking up rubbish. However, a fine of one point results if the bot's action is to attempt to pick up rubbish and there is in fact no rubbish in the cell. A fine of 10 points results from crashing into a wall. Discuss in full the development of a suitable genetic algorithm for evolving this bot. (15 marks)

(c) Explain what is meant by the term 'local optimum' in the context of a genetic algorithm (5 marks)

6

"Cepheus, AlphaGO, and Watson represent visions of the future for Artificial Intelligence" Discuss this statement from the following three perspectives: game playing (8 marks), digital assistants (8 marks), data mining (9 marks).